

What is claimed is:

1. A voltage-controlled tunable filter including:

an input;

an output;

5 a plurality of resonators serially coupled to each other and to the input and the output;

a plurality of tunable capacitors, each of the tunable capacitors being coupled to one of the resonators; and

means for coupling non-adjacent ones of the resonators.

10 2. A voltage-controlled tunable filter according to claim 1, wherein each of the resonators includes one of:

a microstrip, a stripline, a coaxial line, a dielectric resonator, or a waveguide.

3. A voltage-controlled tunable filter according to claim 1, wherein the means for coupling non-adjacent ones of the resonators comprises a series connection of an additional tunable capacitor and a conductor.

15 4. A voltage-controlled tunable filter according to claim 1, wherein the plurality of resonators are mounted on a substrate.

5. A voltage-controlled tunable filter according to claim 1, wherein each of the tunable capacitors comprises:

20 a first electrode;

a tunable dielectric film positioned on the first electrode; and

a second electrode positioned on a surface of the tunable dielectric film opposite the first electrode.

25 6. A voltage-controlled tunable filter according to claim 5, wherein the tunable dielectric film comprises:

barium strontium titanate or a composite of barium strontium titanate.

7. A voltage-controlled tunable filter according to claim 1, wherein each of the tunable capacitors comprises:

a substrate;

30 a tunable dielectric film positioned on the substrate; and

first and second electrodes positioned on a surface of the tunable dielectric film opposite the substrate, the first and second electrodes being separated to form a gap.

8. A voltage-controlled tunable filter according to claim 1, wherein each of the tunable capacitors comprises:

a microelectromechanical capacitor.

9. A voltage-controlled tunable filter according to claim 8, wherein each of the microelectromechanical capacitors comprises one of :

a parallel plate microelectromechanical capacitor, or an interdigital microelectromechanical capacitor.

10. A voltage-controlled tunable filter according to claim 1, wherein the input and the output each comprises one of:

a waveguide aperture, an electric coupling probe, or magnetic coupling probe.

11. A voltage-controlled tunable filter according to claim 1, further comprising:

additional coupling means for coupling non-adjacent ones of the resonators.

12. A voltage-controlled tunable filter according to claim 1, wherein the input includes a first microstrip line having an end capacitively coupled to a first one of the resonators; and wherein the output includes a second microstrip line having an end capacitively coupled to a second one of the resonators.

13. A voltage-controlled tunable filter according to claim 1, wherein each of the resonators comprises a microstrip line.

14. A voltage-controlled tunable filter according to claim 13, wherein the microstrip lines are positioned parallel to each other on a substrate.

15. A voltage-controlled tunable filter according to claim 13, wherein the coupling means comprises:

an additional microstrip line having first and second ends, each capacitively coupled to one of the resonator microstrip lines.

16. A voltage-controlled tunable filter according to claim 15, wherein coupling means further comprises:

an additional tunable capacitor connected in series with the additional microstrip line.

17. A voltage-controlled tunable filter according to claim 1, wherein each of the tunable capacitors comprises a tunable dielectric capacitor including a layer of voltage tunable dielectric material.

18. A voltage-controlled tunable filter according to claim 1, wherein the layer of tunable dielectric material comprises a material selected from the group of:

$\text{Ba}_x\text{Sr}_{1-x}\text{TiO}_3$, $\text{Ba}_x\text{Ca}_{1-x}\text{TiO}_3$, $\text{Pb}_x\text{Zr}_{1-x}\text{TiO}_3$, $\text{Pb}_x\text{Zr}_{1-x}\text{SrTiO}_3$, $\text{KTa}_x\text{Nb}_{1-x}\text{O}_3$, lead lanthanum zirconium titanate, PbTiO_3 , BaCaZrTiO_3 , NaNO_3 , KNbO_3 , LiNbO_3 , LiTaO_3 , PbNb_2O_6 , PbTa_2O_6 , $\text{KSr}(\text{NbO}_3)$ and $\text{NaBa}_2(\text{NbO}_3)_5\text{KH}_2\text{PO}_4$, and compositions thereof.

19. A voltage-controlled tunable filter according to claim 18, wherein the layer of tunable dielectric material further comprises a non-tunable component.